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EXAMINER	
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ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 11/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/898,924	LYSTAD ET AL.	
	Examiner	Art Unit	
	Thomas H. Stevens	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 July 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 July 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3/7/02*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-37 were presented.

2. Claims 6 and 21 were cancelled prior to examination.

3. Claims 1-5,7-20 and 22-37 were examined.

Information Disclosure Statement

4. The 1449 list the affidavits under rule 1.131 by the inventors. This is an improper citation. Thus, the citation has been lined through on the 1449 for these two entries. The affidavits themselves have been fully considered.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

6. Regarding claims 8,9,12,13,16,23,24,27,28,32,34, and 36, the word "associated" renders the claims indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

7. Regarding claims 10 and 25 the phrase "as appropriate" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

8. Furthermore, regarding claims 16-31, the word "system" renders the claim indefinite and ambiguous (i.e., statutory types of invention are undefined) because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Public Use or on Sale

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1-37 are rejected under 35 U.S.C. 102(b) based upon a public use or sale of the invention. The 1.131 affidavits by Lystad et al., indicates, "sometime prior to July 3, 2000 a product ("the Product") incorporating the subject matter described in the attached Exhibit A ("the Subject Matter") was sold to one or more customers of i2 Technologies, Inc.".

11. A review of Exhibit A indicates that the invention, as claimed, was fully disclosed at the time of public use or sale of said product, which occurred more than one year prior to the effective filing date of the invention. Therefore, the subject matter of claims 1-37 is rejected under 102(b) upon public sale/use of the invention.

Claim Rejections - 35 USC § 103

12. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 1-5,7-20 and 22-37 are rejected under 35 U.S.C. 103 (a) as unpatentable by Padmos et al. ("How i2 Integrates Simulation in Supply Chain Optimization" (1999)), in view of French et al. (U.S. Patent 6,266,053 (2001)) and in further view of Leymann et al., (U.S. Patent 6,009,405 (1999)).

Padmos et al. teaches complex analysis associated with extended enterprises via simulation; but doesn't a specific software simulation platform related to workflow. French et al. teaches a technique for representing a visual scene as directed acyclic graph of data and operators that generates a sequence of images frames over specified

time intervals (abstract) for post production phase of the overall process in simulation environments (column 1, lines 2-4 and 10); while, Leymann et al. teaches a computerized transaction execution model consisting of a network of potentially distributive activities (abstract).

At the time the invention, it would have been obvious to one of ordinary skill in the art to use Padmos and French et al. to modify Leymann et al., since it would be in the best interest of a corporation to forecast every possible contingency in light of a volatile, yet competitive, market place.

Claim 1. A process for modeling at least a portion of a workflow (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) comprising: accessing a computer data structure that represents an acyclic directed graph (Leymann: column 17, lines 5-14) comprising a plurality of nodes and one or more edges (Leymann: column 5, 58-65), each of the edges linking two adjacent nodes within the acyclic directed graph (Leymann: column 17, lines 5-14); requesting the value of a first function at a selected node, the value of the first function at the selected node depending at least in part on values of the first function at one or more adjacent nodes lying in a first direction from the selected node within the acyclic directed graph (Leymann: column 17, lines 5-14; French: column 7, lines 55-64), a cached value of at least a second function at the selected node depending only on the value of the first function at the selected node and one or more other values associated with the selected node (Leymann: column 8, lines

29-31); determining whether a cached value of the first function at the selected node is assured to be valid (Leymann: column 19, lines 25-27); if the cached value of the first function at the selected node is not assured to be valid, then recomputing the value of the first function at the selected node based at least in part on the values of the first function at the one or more adjacent nodes and returning the recomputed value of the first function at the selected node (Leymann: column 19, lines 25-40); and if the cached value of the first function at the selected node is assured to be valid, then returning the cached value of the first function at the selected node without recomputing the value of the first function at the selected node (Leymann: column 19, lines 25-40; with column 15, lines 29-44. Note: examiner is taking a broad position in relation to this specific portion of the claim).

Claim 2. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein the workflow comprises a planned flow of resources through a sequence of processing steps (French: column 3, lines 47-50) to transform less finished resources into more finished resources, the flow of resources being represented by the edges within the acyclic directed graph and giving a time-based directionality to the acyclic directed graph (Leymann: column 17, lines 5-14; French: column 7, lines 55-64).

Claim 3. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2

,lines 29-36) wherein the plurality of nodes includes at least one perimeter node representing a source of input for the workflow and at least one non-perimeter node representing a processing step of the workflow (French: column 8, lines 4-13 with figure 2).

Claim 4. The process of claim 3, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein: the workflow is a planned manufacturing workflow (Padmos: figure 1 with pg. 1351, right column 1st paragraph); the source of input is selected from the group consisting of a material input, a labor input, and a data input (French: column 8, lines 4-7; Leymann: column 9, lines 50-55); and the processing step is selected from the group consisting of: performing a manufacturing operation on at least one material input to produce at least one material output (Leymann: column 6, lines 8-33; Leymann: column 9,lines 49-55); and performing a data processing operation on at least one data input to produce at least one data output (Leymann: column 12, lines 15-23).

Claim 5. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein the acyclic directed graph has a time-based directionality and the first direction is selected from the group consisting of an upstream direction which corresponds to earlier in time and a downstream direction which corresponds to later in time (French: figure 2, with column 8, lines 19-26).

Claim 7. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein the cached value of the first function at the selected node may be invalid due to one or more changes in the workflow in the first direction from the selected node (Leymann: column 19, lines 25-39).

Claim 8. The process of Claim 7, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67, column 19, lines 25-39; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein at least one change in the workflow is selected from the group consisting of change in availability of a material input (Leymann: column 15, lines 29-35); a change to a runtime associated with a manufacturing operation (Leymann: column 4, lines 31-32); and a change in a due date for a customer order (Leymann: column 15 ,lines 28-49).

Claim 9. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein: the selected node is associated with a Boolean variable (Leymann: column 12, lines 31-44) indicating whether the cached value of the first function at the selected node is assured to be valid; and determining whether the cached value of the first function at the selected node is assured to be valid comprises

determining the value of the Boolean variable at the selected node (Leymann: column 12, lines 31-44; and column 11,lines 55-60).

Claim 10. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein requesting the value of the first function at the selected node comprises calling a corresponding node-local method of the selected node, the node-local method determining whether the cached value of the function at the selected node (French: column 4, lines 54-63) is assured to be valid and returning either the recomputed value or the cached value, as appropriate, of the function at the selected node.

Claim 11. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) further comprising imposing an indication of possible invalidity on the cached values of the first function at all nodes in a second direction from the selected node in response to determining that the cached value of the first function at the selected node is not assured to be valid, the second direction being the opposite direction from the first direction (Leymann: column 19, lines 25-39).

Claim 12. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column

2, lines 29-36) wherein the value of the first function at the selected node is selected from the group consisting of: an earliest possible starting time (EPST) for a portion of the workflow associated with the selected node, the value of the second function at the selected node being an earliest possible ending time (EPET) for the portion of the workflow associated with the selected node (French: column 22, claim 16); an EPET for a portion of the workflow associated with the selected node, the value of the second function at the selected node being an EPST for the portion of the workflow associated with the selected node (French: column 22, claim 16); a latest possible starting time (LPST) for a portion of the workflow associated with the selected node, the value of the second function at the selected node being a latest possible ending time (LPET) for the portion of the workflow associated with the selected node (French: column 22, claim 16); and an LPET for a portion of the workflow associated with the selected node, the value of the second function at the selected node being an LPST for the portion of the workflow associated with the selected node (French: column 22, claim 16).

Claim 13. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the value of the first function at the selected node is selected from the group consisting of: a maximum quantity of an output of a portion of the workflow associated with the selected node for which production can be started, given an available supply of at least one input at a selected time (French: column 22, claim 16; Leymann: column 12, lines 15-23); and a maximum quantity of an output of a

portion of the workflow associated with the selected node for which production can be completed, given an available supply of at least one input at a selected time (French: column 22, claim 16; Leymann: column 12, lines 15-23).

Claim 14. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the value of the first function at the selected node is selected from the group consisting of a minimum quantity of an input required to start production within at least a portion of the workflow, given a desired minimum quantity of an output that is to be produced by that portion of the workflow by a specified time (French: column 22, claim 16; Leymann: column 12, lines 15-23); a minimum quantity of an input required to complete production within at least a portion of the workflow, given a desired minimum quantity of an output that is to be produced by that portion of the workflow by a specified time (French: column 22, claim 16; Leymann: column 12, lines 15-23).

Claim 15. The process of Claim 1, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the process is implemented using at least one component selected from the group consisting of a planner, a scheduler, and an optimizer (French: column 15, line 3).

Claim 16. A system for modeling at least a portion of a workflow (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67, Leymann: column 19, lines 59-67; and French: column 1, lines 11-12 with column 2, lines 29-36), the system operating on one more computer processors collectively operable to: access a computer data structure that represents an acyclic directed graph (Leymann: column 17, lines 5-14) comprising a plurality of nodes and one or more edges, each of the edges (Leymann: column 5, lines 58-65) linking two adjacent nodes within the acyclic directed graph (Leymann: column 17, lines 5-14); request the value of a first function at a selected node, the value of the first function at the selected node depending at least in part on values of the first function at one or more adjacent nodes lying in a first direction from the selected node within the acyclic directed graph (Leymann: column 17, lines 5-14; French: column 7, lines 55-64), a cached value of at least a second function at the selected node depending only on the value of the first function at the selected node and one or more other values associated with the selected node (Leymann: column 8, lines 29-31); determine whether a cached value of the first function at the selected node is assured to be valid (Leymann: column 19, lines 25-27); if the cached value of the first function at the selected node is not assured to be valid, then recompute the value of the first function at the selected node based at least in part on the values of the first function at the one or more adjacent nodes and return the recomputed value of the first function at the selected node (Leymann: column 19, lines 25-40 with column 15, lines 29-44); and if the cached value of the first function at the selected node is assured to be valid, then return the cached value of the first function at the selected node without

recomputing the value of the first function at the selected node (Leymann: column 19, lines 25-40; with column 15, lines 29—44. Note: examiner is taking a broad position in relation to this specific portion of the claim).

Claim 17. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein the workflow comprises a planned flow of resources through a sequence of processing steps (French: column 3, lines 47-50) to transform less finished resources into more finished resources, the flow of resources being represented by the edges within the acyclic directed graph and giving a time-based directionality to the acyclic directed graph (Leymann: column 17, lines 5-14;French: column 7, lines 55-64).

Claim 18. The of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein the plurality of nodes includes at least one perimeter node representing a source of input for the workflow and at least one non-perimeter node representing a processing step of the workflow (French: column 8, lines 4-13 with figure 2).

Claim 19. The system of Claim 18, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein: the workflow is a planned manufacturing workflow (Padmos: figure 1 with pg. 1351, right column 1st paragraph); the source of input is selected from

the group consisting of a material input, a labor input, and a data input; and the processing step is selected from the group consisting of: performing a manufacturing operation on at least one material input to produce at least one material output (Leymann: column 6, lines 8-33; Leymann: column 9,lines 49-55); and performing a data processing operation on at least one data input to produce at least one data output.

Claim 20. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein the acyclic directed graph has a time-based directionality and the first direction is selected from the group consisting of an upstream direction which corresponds to earlier in time and a downstream direction which corresponds to later in time (French: figure 2, with column 8, lines 19-26).

Claim 22. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2 ,lines 29-36) wherein the cached value of the first function at the selected node may be invalid due to one or more changes in the workflow in the first direction from the selected node (Leymann: column 19, lines 25-39).

Claim 23. The system of Claim 22, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67, column 19, lines 25-39; and French: column 1,

lines 11-12 with column 2 ,lines 29-36) wherein at least one change in the workflow is selected from the group consisting of: a change in availability of a material input (Leymann: column 15, lines 29-35); a change to a runtime associated with a manufacturing operation; and a change in a due date for a customer order (Leymann: column 15 ,lines 28-49).

Claim 24. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein: the selected node is associated with a Boolean variable (Leymann: column 12, lines 31-44) indicating whether the cached value of the first function at the selected node is assured to be valid; and determining whether the cached value of the first function at the selected node is assured to be valid comprises determining the value of the Boolean variable at the selected node (Leymann: column 12, lines 31-44; and column 11,lines 55-60).

Claim 25. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein requesting the value of the first function at the selected node comprises calling a corresponding node-local method of the selected node, the node-local method determining whether the cached value of the function at the selected node(French: column 4, lines 54-63) is assured to be valid and returning either the

recomputed value or the cached value, as appropriate, of the function at the selected node.

Claim 26. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the one or more computer processors are further operable to impose an indication of possible invalidity on the cached values of the first function at all nodes in a second direction from the selected node in response to determining that the cached value of the first function at the selected node is not assured to be valid, the second direction being the opposite direction from the first direction (Leymann: column 19, lines 25-39).

Claim 27. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the value of the first function at the selected node is selected from the group consisting of: an earliest possible starting time (EPST) for a portion of the workflow associated with the selected node, the value of the second function at the selected node being an earliest possible ending time (EPET) for the portion of the workflow associated with the selected node (French: column 22, claim 16); an EPET for a portion of the workflow associated with the selected node, the value of the second function at the selected node being an EPST for the portion of the workflow associated with the selected node; a latest possible starting time (LPST) for a portion of the

workflow associated with the selected node, the value of the second function at the selected node being a latest possible ending time (LPET) for the portion of the workflow associated with the selected node (French: column 22, claim 16); and an LPET for a portion of the workflow associated with the selected node, the value of the second function at the selected node being an LPST for the portion of the workflow associated with the selected node (French: column 22, claim 16).

Claim 28. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the value of the first function at the selected node is selected from the group consisting of: a maximum quantity of an output of a portion of the workflow associated with the selected node for which production can be started, given an available supply of at least one input at a selected time(French: column 22, claim 16; Leymann: column 12, lines 15-23); and a maximum quantity of an output of a portion of the workflow associated with the selected node for which production can be completed, given an available supply of at least one input at a selected time (French: column 22, claim 16; Leymann: column 12, lines 15-23).

Claim 29. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the value of the first function at the selected node is selected from the group consisting of: a minimum quantity of an input required to start production

within at least a portion of the workflow, given a desired minimum quantity of an output that is to be produced by that portion of the workflow by a specified time (French: column 22, claim 16; Leymann: column 12, lines 15-23); a minimum quantity of an input required to complete production within at least a portion of the workflow, given a desired minimum quantity of an output that is to be produced by that portion of the workflow by a specified time (French: column 22, claim 16; Leymann: column 12, lines 15-23).

Claim 30. The system of Claim 16, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein the process is implemented using at least one component selected from the group consisting of a planner, a scheduler, and an optimizer (French: column 15, line 3; and Leymann: column 5, lines 44-54).

Claim 31. A system for modeling at least a portion of a workflow, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) the system comprising: means for accessing a computer data structure that represents an acyclic directed graph comprising a plurality of nodes and one or more edges (Leymann: column 17, lines 5-14; French: column 7, lines 55-64), each of the edges (Leymann: column 4, lines 26-28; French: column 7, lines 55-65) linking two adjacent nodes within the acyclic directed graph; means for requesting the value of a first function at a selected node, the value of the first function at the selected node depending at least in part on values of the first

function at one or more adjacent nodes lying in a first direction from the selected node within the acyclic directed graph, a cached value of at least a second function at the selected node depending only on the value of the first function at the selected node and one or more other values associated with the selected node; means for determining whether a cached value of the first function at the selected node is assured to be valid; means for, if the cached value of the first function at the selected node is not assured to be valid (French: column 13, lines 56-62 with figure 2; with Leymann: column 19, lines 25-39) recomputing the value of the first function at the selected node based at least in part on the values of the first function at the one or more adjacent nodes and returning the recomputed value of the first function at the selected node; and means for, if the cached value of the first function at the selected node is assured to be valid, returning the cached value of the first function at the selected node without recomputing the value of the first function at the selected node (Leymann: column 19, lines 25-40; with column 15, lines 29-44. Note: examiner is taking a broad position in relation to this specific portion of the claim).

Claim 32. A method of modeling at least a portion of a workflow, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) comprising: accessing a computer data structure that represents an acyclic directed graph comprising a plurality of nodes and one or more edges, each of the edges linking two adjacent nodes within the acyclic directed graph, the acyclic directed graph having a time-based directionality; requesting

the value of a first function at a selected node, the value of the first function at the selected node depending at least in part on values of the first function at one or more adjacent nodes lying in a first direction from the selected node (French: columns 4 and 5, lines 54-67 and 1-11, respectively); determining whether a cached value of the first function at the selected node is assured to be valid; if the cached value of the first function at the selected node is assured to be valid, then returning the cached value (French: column 13, lines 56-62 with figure 2; with Leymann: column 19, lines 25-39) of the first function at the selected node without recomputing the value of the first function at the selected node; and if the cached value of the first function at the selected node is not assured to be valid, then: for each adjacent node(French: column 13, lines 56-62 with figure 2; with Leymann: column 19, lines 25-39), obtaining the value of a second function at the adjacent node, the value of the second function at the adjacent node depending at least in part on the values of the first function at the adjacent node (Leymann: column 19, lines 25-39); for each adjacent node, adding the value of the second function at the adjacent node to a value associated with movement in a second direction opposite the first direction from the adjacent node to the selected node along the corresponding edge, this addition generating a total value for the adjacent node (Leymann: column 19, lines 25-39); determining a maximum total value over all adjacent nodes; if the maximum total value is the same as a cached value of the first function at the selected node, then providing an indication associated with the selected node that the cached value of the first function at the selected node is assured to be valid and returning the cached value of the first function at the selected node; and if the

maximum value is different than the cached value of the first function at the selected node, then providing an indication associated with the selected node that the cached value (French: column 13, lines 56-62 with figure 2; with Leymann: column 19, lines 25-39) of the second function at the selected node is not assured to be valid, updating the cached value of the first function at the selected node to the maximum total value, providing an indication associated with the selected node that the cached value of the first function at the selected node is assured to be valid, and returning the cached value of the first function at the selected node.

Claim 33. The method of Claim 32, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) wherein: the value of the first function at a node comprises an earliest possible start time for a manufacturing operation represented by the node; and the value of the second function at a node comprises an earliest possible end time for a manufacturing operation represented by the node (French: column 22, lines 48-52; with Padmos: pg. 1351, right column, 1st paragraph).

Claim 34. A method of modeling at least a portion (French: column 22, lines 34-37) of a workflow (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36), comprising: accessing a computer data structure that represents an acyclic directed graph comprising a plurality of nodes and one or more edges, each of the edges linking two

adjacent nodes within the acyclic directed graph, the acyclic directed graph having a time-based directionality; requesting the value of a first function at a selected node, the value of the first function at the selected node depending at least in part on values of the first function at one or more adjacent nodes lying in a first direction from the selected node; requesting the value of a second function at the selected node, the value of the second function at the selected node depending at least in part on the values of the first function at the adjacent nodes, a cached value(French: column 13, lines 56-62 with figure 2; with Leymann: column 19, lines 25-39) of the second function at the selected node being returned in response to the request; determining whether a cached value of the first function at the selected node is assured to be valid; if the cached value of the first function at the selected node is assured to be valid, (French: column 13, lines 56-62 with figure 2; with Leymann: column 19, lines 25-39) then returning the cached value of the first function at the selected node without recomputing the value of the first function at the selected node; and if the cached value of the first function at the selected node is not assured to be valid, then recomputing the value of the first function at the selected node based at least in part on the values of the first function at the adjacent nodes, providing an indication associated with the selected node that the cached value of the first function at the selected node is assured to be valid, and retuning the recomputed value of the first function at the selected node (Leymann: column 19, lines 25-40; with column 15, lines 29-44. Note: examiner is taking a broad position in relation to this specific portion of the claim).

Claim 35. The method of Claim 34, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36 and column 22, lines 34-37) wherein: the value of the first function at a node comprises an earliest possible end time for a manufacturing operation represented by the node (French: column 22, claim 16; with Padmos: pg.1351, right column, 1st paragraph); and the value of the second function at a node comprises an earliest possible start time for a manufacturing operation represented by the node (French: column 22, claim 16; with Padmos: pg.1351, right column, 1st paragraph).

Claim 36. A method of modeling at least a portion of a workflow, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column 2, lines 29-36) comprising: accessing a computer data structure that represents an acyclic directed graph (Leymann: column 17, lines 5-14; French: column 7, lines 55-64) comprising a plurality of nodes and one or more edges, each of the edges linking two adjacent nodes within the acyclic directed graph, the acyclic directed graph having a time-based directionality; requesting the value of a first function at a selected node, the value of the first function at the selected node depending at least in part on values of the first function at one or more adjacent nodes lying in a first direction from the selected node (Leymann: column 8, lines 29-31); determining whether a cached value of the first function at the selected node is assured to be valid (Leymann: column 19, lines 25-40); if the cached value of the first function at the selected node is assured to be valid, then returning the cached value of the first

function at the selected node without recomputing the value of the first function at the selected node (Leymann: column 19, lines 25-40); and if the cached value of the first function at the selected node is not assured to be valid, then: perform a first iteration through the edges lying in the first direction from the selected node, the first iteration comprising: determining whether an edge might make invalid the value of the first function at the selected node; if the edge will not make invalid the value of the first function at the selected node, then either processing the next edge within the first iteration or, if there are no more edges to be processed within the first iteration, providing an indication associated (Leymann: column 2, lines 16-24) with the selected node that the cached value of the first function at the selected node is assured to be valid and returning the cached value of the first function at the selected node (Leymann: column 19, lines 25-40); if the edge might make invalid the value of the first function at the selected node, then providing an indication associated with the edge that the edge does not make invalid the value of the first function at the selected node(Leymann: column 2, lines 16-24); if the edge corresponds to an adjacent node lying in the first direction from the selected node that is at least partially responsible for the value of the first function at the selected node, then exit the first iteration and perform a second iteration through the edges lying in the first direction from the selected node (Leymann: column 5, lines 45-54); and if the edge corresponds to an adjacent node lying in the first direction from the selected node that is not at least partially responsible for the value of the first function at the selected node, then: requesting the value of a second function at the adjacent node corresponding to the edge (Leymann: column 4, lines 54-67 and

column 5, lines1-11 and 41-54); adding the returned value of the second function at the adjacent node to a value associated with movement in a second direction opposite the first direction from the adjacent node to the selected node along the edge, this addition generating a total value for the edge (Leymann: column 5, lines 26-40); if the total value for the edge is greater than the cached value of the first function at the selected node, then exit the first iteration and perform the second iteration (Leymann: column 5, lines 26-40; and column 19, lines 25-40); and if the total value for the edge is not greater than the cached value of the first function at the selected node, then either process the next edge within the first iteration or, if there are no more edges to be processed within the first iteration, providing an indication associated with the selected node that the cached value of the first function at the selected node is assured to be valid and returning the cached value of the first function at the selected node (Leymann: column 5, lines 26-40; and column 19, lines 25-40); the second iteration through the edges lying in the first direction from the selected node comprising: requesting the value of the second function at the adjacent nodes corresponding to the edges (Leymann: column 5, lines 26-40; and column 19, lines 25-40); adding the returned values of the second function at the adjacent nodes to the values associated with movement in the second direction from the adjacent nodes to the selected node along the edges to generate total values for the edges (Leymann: column 12, lines 15-23 and 58-65); determining a maximum total value over all the adjacent nodes; perform a third iteration through the edges lying in the first direction from the selected node comprising: providing an indication associated with all edges that produced the maximum total value that these edges are at least partially

responsible for the value of the first function at the selected node(Leymann: column 12, lines 15-23 and 58-65); providing an indication associated with all edges that did not produce the maximum total value that these edges are not at least partially responsible for the value of the first function at the selected node (Leymann: column 12, lines 15-23 and 58-65; with column 19, lines 25-39); and providing an indication associated with each edge that the edge will not make invalid the value of the first function at the selected node; if the maximum total value is equal to the cached value of the first function at the selected node, then providing an indication that the cached value of the first function is valid, and returning the cached value of the first function at the selected node without recomputing (Leymann: column 19, lines 25-40; with column 15, lines 29-44. Note: examiner is taking a broad position in relation to this specific portion of the claim) the value of the first function at the selected node (Leymann: column 10, lines 10-34); and if the maximum total value is different from the cached value of the first function at the selected node, then providing an indication that the cached-value of the second function is not valid (Leymann: column 9, lines 1-25) updating the cached value of the first function at the selected node to the maximum total value, providing an indication associated with the selected node that the cached value of the first function at the selected node is assured to be valid (Leymann: column 19, line 25-39), and returning the cached value of the first function at the selected node.

Claim 37. The method of Claim 36, (Padmos: pg. 1353-1354, section 7 with figures 1 and 2; Leymann: column 5, lines 55-67; and French: column 1, lines 11-12 with column

2, lines 29-36) wherein: the value of the first function at a node comprises an earliest possible start time for a manufacturing operation represented by the node; and the value of the second function at a node comprises an earliest possible end time for a manufacturing operation represented by the node (French: column 22, lines 48-52; with Padmos: pg. 1351, right column, 1st paragraph).

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mr. Tom Stevens whose telephone number is (571) 271-0365, Monday-Friday (8:00 am- 4:30 pm) or contact Supervisor Mr. Kevin Teska at (571) 272-3716. The fax number for the group is 703-308-1396.

Any inquires of general nature or relating to the status of this application should be directed to the Group receptionist whose phone number is (571)272-1400

October 19, 2004

THS

JEAN R. HOMERE
PRIMARY EXAMINER